

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2000-231200

(43)Date of publication of application : 22.08.2000

(51)Int.Cl.

G03F 7/26

G03F 7/004

G03F 7/023

H01L 21/027

(21)Application number : 11-032512

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(22)Date of filing :

10.02.1999

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(54) PHOTORESIST COMPOSITION

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a photoresist composition to be used for the manufacture a semiconductor, superior in uniform coating and small in pattern defect after development and wide in focal depth.

SOLUTION: The photoresist coating composition comprising at least an alkali-soluble resin and a radiation-sensitive material and a solvent is manufactured under normal pressure and stored airtightly in a vessel is exposed to a reduced pressure of 200 mm Hg, and after that time, an increase of particles of $\geq 0.3 \mu\text{m}$ particle diameter is ≤ 500 pieces 1 ml of the liquid.

LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision
of rejection]

[Kind of final disposal of application other
than the examiner's decision of rejection
or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's
decision of rejection]

[Date of requesting appeal against
examiner's decision of rejection]

[Date of extinction of right]

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CLAIMS

[Claim(s)]

[Claim 1] The photoresist constituent for semi-conductor manufacture whose
increment of the particle count in liquid with a particle size [after holding this
constituent by which sealing maintenance is carried out into the container in ordinary
pressure under reduced pressure of 200mmHg] of 0.3 micrometers or more it is the
photoresist constituent which contains alkali fusibility resin, the radiation-sensitive
matter, and a solvent at least, and is 500 or less pieces/ml.

[Claim 2] The photoresist constituent according to claim 1 with which a solvent is
characterized by containing the ketones of 120 degrees C or more of boiling points.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the photoresist constituent used for semi-conductor manufacture of the high quality accumulated highly in detail about a photoresist constituent.

[0002]

[Description of the Prior Art] By current, if high integration of it is carried out and dynamic random access memory (DRAM) is taken for an example whenever an integrated circuit follows a year, although it has 64M bit memory capacity, formal production is beginning to be started and also it is progressing to high integration of 128M bit or 256M bit. In connection with it, the demand to a photolithography technique indispensable to production of an integrated circuit is also becoming severe every year, and the engine performance in which now the pattern formation of a quarter micron is possible is demanded also in the photoresist used.

[0003] Although development of the photoresist spreading constituent of high performance is wholeheartedly performed in order to fill such a demand, on the other hand, in addition to the homogeneity of engine performance, such as essential high resolution, sensibility, and spreading thickness, the more highly efficient constituent is demanded from viewpoints, like there are few pattern defects after development from the semi-conductor manufacture process side. For example, the depth of focus which shows the admissibility of the deflection of the pattern configuration over a focal change or line breadth is also one of the important engine performance. In an actual integrated circuit, a gap of a focus occurs at the time of exposure by the effect and the stepper of a substrate level difference of the photoresist film, and the formation of a pattern form status change and dimension fluctuation arise. If the depth of focus is large, even if a gap of a focus arises, the formation of a pattern form status change and dimension fluctuation are small, but if the depth of focus is narrow, the formation of a pattern form status change and dimension fluctuation will also generate a gap of few focuses. In order to manufacture a stable integrated circuit, a photoresist spreading constituent with the large depth of focus is needed.

[0004] Moreover, if the spreading homogeneity within a wafer side is bad, in being intense, the phenomenon called visually observable striae SHON will arise. Striae SHON is the phenomenon in which tell a radial the phenomenon in which a muscle-like

pattern appears and thin Tokoro of spreading thickness and a thick place are distributed over the muscle of this radial by turns from the wafer core. Usually, although the surfactant was added as a spreading nature amelioration agent and striae SHON is improved, since it is not improvable depending on the class of solvent, the pile solvent is asked for striae SHON by the lifting.

[0005] Furthermore, in order to control the fall of the productivity by enlargement of the chip size accompanying the advancement of an integrated circuit in recent years, diameter[of macrostomia]-izing of a use wafer is prosperous, the conventional 8 inch-ization is attained, and examination of inch[12 more]-izing is also performed briskly. In the lithography technique in integrated-circuit manufacture, the trouble caused by a stepper's application by diameter-ization of macrostomia until now was stopped by the minimum. However, in order to correspond to the further diameter-ization of macrostomia, reduction of the pattern defect of the origins, such as air bubbles of the photoresist paint film which it becomes impossible to disregard the effect in sheet down stream processing, such as spreading and development, and is produced in this process, has come to be accepted to be a factor important for stable manufacture of an integrated circuit. On the other hand, although various photoresist solvents and the manufacture approaches are also examined corresponding to quality improvement of such a photoresist solution, it has not resulted in essential solution only by changing a solvent.

[0006]

[Problem(s) to be Solved by the Invention] In view of the aforementioned background, the purpose of this invention is excellent in spreading homogeneity, and offering a photoresist constituent with the large depth of focus few has the pattern defect of a developer.

[0007]

[Means for Solving the Problem] The result of having repeated examination variously paying attention to the dissolved gas in the inside of liquefied of the photoresist constituent which participates in generating of a pattern defect deeply in order that this invention person etc. might solve the above-mentioned technical problem, When actually manufacturing a semi-conductor to a surprising thing, in spite of using a photoresist constituent under ordinary pressure conditions The air bubbles resulting from degassing when changing a photoresist constituent into a reduced pressure condition affect pattern formation, Therefore, when controlling the increment of the particle count in liquid after holding a photoresist constituent in the reduced pressure condition below to fixed numbers, it excelled in spreading homogeneity and the pattern

defect also completed a header and this invention for a photoresist constituent with the large depth of focus being obtained few.

[0008] That is, the summary of this invention is a photoresist constituent which contains alkali fusibility resin, the radiation-sensitive matter, and a solvent at least, and consists in the photoresist constituent for semi-conductor manufacture whose increment of the particle count in liquid with a particle size [after holding this constituent by which sealing maintenance is carried out into the container under reduced pressure of 200mmHg in ordinary pressure] of 0.3 micrometers or more is 500 or less pieces/ml.

[0009]

[Embodiment of the Invention] As alkali fusibility resin used for this invention constituent, the various alkali fusibility resin generally used for photoresist manufacture can be used. Specifically novolak resin, polyhydroxy styrene or its derivative, a styrene maleic anhydride copolymer, etc. are mentioned, and it is novolak resin, polyhydroxy styrene, or its derivative preferably, and is novolak resin especially preferably.

[0010] The novolak resin used for this invention constituent A phenol, o-cresol, m-cresol, p-cresol, 3-ethylphenol, Alkylphenols, such as 2, 5-xyleneol, and 3,5-xyleneol Alkoxy **, such as 2-methoxy phenol, 4-methoxyphenol, and 4-phenoxy phenol, aryloxy phenols, Naphthols, such as alpha-naphthol, beta-naphthol, and 3-methyl-alpha-naphthol 1, 3-dihydroxybenzene, 1, 3-dihydroxy-2-methylbenzene, Hydroxy aromatic compounds, such as polyhydroxy benzenses, such as 1, 2, 3-trihydroxy benzene, 1 and 2, 3-trihydroxy-5-methylbenzene, 1 and 3, and 5-trihydroxy benzene, Aliphatic series aldehydes, such as formaldehyde, a paraformaldehyde, an acetaldehyde, and a paraldehyde By making a hydrochloric acid, a sulfuric acid, oxalic acid, etc. into a catalyst, mixed heating is carried out, the polycondensation of the carbonyl compounds, such as alkyl ketones, such as aromatic aldehyde, such as a benzaldehyde, and an acetone, can be carried out, and they can be manufactured. Furthermore, the thing which the novolak resin used preferably makes a catalyst any one or more sorts of more than a kind of m-cresol, p-cresol, 2, and 5-xyleneol and the 3,5-xyleneol, formaldehyde and an acetaldehyde, and the paraldehyde for a hydrochloric acid, oxalic acid, etc., carries out mixed heating, and carries out a polycondensation and by which it was manufactured is mentioned. The resin especially manufactured [paraldehyde / a formaldehyde independent or formaldehyde and the acetaldehyde, or] in m-cresol, p-cresol and 2, and 5-xyleneol by carrying out mixed heating, using a hydrochloric acid, oxalic acid, etc. as a catalyst,

and carrying out a polycondensation is desirable, and improvement in resolution is remarkable by especially use of this resin.

[0011] As polystyrene equivalent weight average molecular weight (only henceforth molecular weight), it is desirable especially desirable that it is 30,000 or less, and the NOHORAKKU resin used for this invention is 20,000 or less. On the other hand, 2,500 or more are desirable especially desirable, and the minimum of molecular weight is 3,000 or more. Since heat-resistant degradation of a photoresist constituent is remarkable when molecular weight is too low, and there is an inclination for degradation of sensibility to become remarkable if too high, to stable manufacture of an integrated circuit, it may not be desirable.

[0012] As polyhydroxy styrene or its derivative, the polymerization of the hydroxystyrene derivatives, such as 4-hydroxystyrene, 3-methyl-4-hydroxystyrene, and 3-chloro-4-hydroxystyrene, can be carried out according to a well-known approach, and it can manufacture. What returned the obtained resin by hydrogen etc. further if needed, and made extinction of a short wavelength field low may be used. Moreover, what protected the hydroxyl group of the manufactured polyhydroxy styrene in the protective group from which it is desorbed by existence of an acid can be used. As a suitable protective group, alkyloxy carbonyl groups, such as acetal radicals, such as for example, 1-ethoxyethyl radical, 1-cyclohexyloxy ethyl group, an i-butoxy ethyl group, and a tetrahydropyranyl group, and a tert-butoxycarbonyl radical, etc. are mentioned. These protective groups can use one sort or two sorts or more. Moreover, the aromatic compound monomer for manufacturing these alkali fusibility resin may have substituents, such as a halogen atom, a nitro group, and an ester group, unless it has a bad influence on this invention.

[0013] The so-called photo-oxide generating agent which generates an acid can be mentioned by absorbing the sensitization agent and light containing an orthoquinone diazido radical as a radiation-sensitive compound used for this invention constituent. As a sensitization agent, usually 1, a 2-benzoquinone diazido-4-sulfonic acid, They are orthoquinone diazido system sensitization agents, such as ester, such as a 1, 2-naphthoquinonediazide-4-sulfonic-acid, 1, and 2-naphthoquinonediazide-5-sulfonic acid, or an amide. Specifically A polyhydroxy alkyl compound or novolak resin, such as a glycerol and pentaerythritol, Bisphenol A, 4, 4', a 4"-trihydroxy phenylmethane, Polyhydroxy aromatic compounds, such as gallate, quercetine, morin, and a polyhydroxy benzophenone, and 1, a 2-benzoquinone diazido-4-sulfonic acid, Ester, such as a 1, 2-naphthoquinonediazide-4-sulfonic-acid, 1, and 2-naphthoquinonediazide-5-sulfonic acid, is used preferably. Also in this, ester

with phenol nature hydroxyl group-containing compound is desirable, and especially ester with novolak resin is desirable.

[0014] As a photo-oxide generating agent, well-known photo-oxide generating agents, such as an organic halogenated compound, a sulfonate, onium salt, diazonium salt, and a disulfon compound, etc. are mentioned. Preferably Bis(cyclohexyl sulfonyl) diazomethane, bis(phenyl sulfonyl) diazomethane, Bis-sulfonyl diazomethane derivatives, such as cyclohexyl sulfonyl-(4-methoxyphenyl sulfonyl) diazomethane The onium salt which has alkyl sulfonate anions, such as iodonium salt like di(t-butylphenyl) iodonium camphor sulfonate, is mentioned, and these can mix and use independent or two sorts or more.

[0015] Moreover, the cross linking agent of the alkali fusibility resin which acts under acid conditions can also be added if needed. As an example of a cross linking agent, the compound which contains cross-linking radicals, such as hydroxymethyl groups, such as hexamethoxy methylation melamine, N and N, N', and N'-tetra-hydroxymethyl SAKUSHINAMIDO, a tetramethoxy methylation urea, 2 and 4, and 6-trihydroxy methylation phenol, a methoxymethyl radical, and an ethoxy methyl group, in [two or more] 1 molecule is mentioned.

[0016] As a solvent used for this invention constituent, for example Ethylene glycol ether ester, such as ethylcellosolve acetate 3-methoxy methyl propionate, 3-methoxy ethyl propionate, Alkoxy carboxylate, such as 3-ethoxy methyl propionate and 3-ethoxy ethyl propionate Propylene-glycol-monomethyl-ether acetate, propylene glycol monoethyl ether acetate, Propylene glycol ether ester, such as propylene glycol monopropylether acetate The propylene glycol monoethyl ether, the propylene glycol monobutyl ether, Propylene glycol ether, such as dipropylene glycol wood ether Alkylene glycol diester, such as propylene glycol diacetate and ethylene glycol diacetate Ketone ester, such as methyl pyruvate and pyruvic-acid ethyl, an acetylacetone, Cyclopentanone, 2-heptanone, 3-heptanone, 4-heptanone, Ketones, such as a cyclohexanone and a methyl ethyl ketone, acetol, Ketone alcohol, such as diacetone alcohol, N,N-dimethylacetamide, Amide derivatives, such as N,N-dimethylformamide and N-methyl pyrrolidone Ether, such as an anisole, a tetrahydrofuran, and dioxane, methyl lactate, Ethyl lactate, glycolic-acid ethyl, 2-hydroxy butanoic acid ethyl, 2-hydroxy-3-methyl butanoic acid methyl, 2-hydroxy-3-methyl butanoic acid ethyl, Hydroxycarboxylic acid ester, such as 2-hydroxy-2-methyl ethyl propionate Methyl acetate, ethyl acetate, butyl acetate, amyl acetate, ethyl acetate, butyl butyrate, Carboxylate, such as oxalic acid diethyl, a diethyl maleate, methyl benzoate, and ethyl propionate Cyclic ester, such as

gamma-butyrolactone, gamma-valerolactone, and delta-valerolactone All are usable if alkali fusibility resin and radiation-sensitive matter, such as carbonates, such as dimethyl carbonate and diethyl carbonate, toluene, and a xylene, may be dissolved good. [, such as aromatic hydrocarbon,] It is desirable in these solvents in respect of the handling nature of the independent or photoresist constituent from which the solvent mixed two or more sorts is obtained, spreading nature, preservation stability, etc. in propylene glycol ether, such as ketones, such as lactate, such as propylene glycol ether ester, such as alkoxy carboxylate, such as 3-methoxy methyl propionate, and propylene-glycol-monomethyl-ether acetate, and ethyl lactate, and 2-heptanone, and a propylene-glycol-monomethyl-ether glycol. when the boiling points, such as an acetylacetone, heptanone, and a cyclohexanone, be ketones 120 degrees C or more and some or all of a solvent contain 2-heptanone especially, while there be an advantage from which the photoresist constituent which be excellent in a spreading property and preservation stability be obtain, there be an inclination for the effect by degassing when make it reduced pressure conditions to be large, and the effectiveness of this invention of control the increment of the particle count in liquid after reduced pressure be especially do so notably. Moreover, it is effective in manufacture of the photoresist constituent of this invention especially to use a solvent system with few dissolved amounts of nitrogen and oxygen as a solvent.

[0017] The concentration of the alkali fusibility resin in the photoresist constituent of this invention is usually 1 - 30 % of the weight, and the concentration of the radiation-sensitive matter is usually 0.01 - 15 % of the weight. And it is usually twice [0.001 - 1 weight] the rate of the radiation-sensitive matter to alkali fusibility resin of this.

[0018] Furthermore, to the photoresist constituent of this invention, a surfactant can be added as a spreading disposition top agent. The class and addition are important for manufacture of the photoresist constituent of efficient this invention in order to participate in the foamability in photoresist liquid deeply in combination with a solvent. As a surface active agent used, for example The polyoxyethylene lauryl ether, Polyoxyethylene alkyl ether, such as polyoxyethylene stearylether and the polyoxyethylene oleyl ether Polyoxyethylene alkylphenol ether and polyethylene-glycol JIRAU rates, such as the polyoxyethylene octyl phenol ether and the polyoxyethylene nonyl phenol ether, An Nonion system surfactant like polyethylene-glycol dialkyl ether, such as polyethylene-glycol distearate, EFUTOPPU EF301, EF303, and EF352 (new Akita formation a trade name, Make), The megger fucks F171, F173, F179, and R08 (a trade name, Dainippon Ink make), The

fluorochemical surfactant of the shape of a straight chain which has the alkyl group fluoride and perfluoroalkyl radical illustrated by JP,57-178242,A, Fluorad FC430 and FC431 (a trade name, Sumitomo 3M make), the Asahi guard AG710, Sir chlorofluocarbon S-381, S-382, and SC101, SC102, SC103, SC104, SC105 and SC106 (a trade name ---) fluorochemical surfactants, such as the Asahi Glass Co., Ltd. make, and organosiloxane polymer KP341 (a trade name ---) The Shin-Etsu Chemical Co., Ltd. make, an acrylic-acid system or the methacrylic-acid system (**) polymer poly flows No75 and No95 (a trade name, product made from Kyoeisha Fats-and-oils Chemical industry), etc. can be mentioned. It is a fluorochemical surfactant preferably and Fluorad FC430, the megger fuck F-179, R08, and Sir chlorofluocarbon S381 can be mentioned especially preferably. In order to obtain the photoresist constituent of this invention, 1000 ppm or less of an upper limit are [the addition of these surface active agents] desirable to a photoresist constituent. Furthermore, it is 500 ppm or less preferably, and is 150 ppm or less especially preferably. The minimum of an addition is 1 ppm or more, is 10 ppm or more preferably, and is 25 ppm or more especially preferably. Moreover, the sensitizer for the extinction nature ingredient for lessening effect of the scattered reflection light from a substrate and the improvement in sensibility etc. can also add a triphenyl methanol, a triphenylmethane color, a benzopinacol, etc. further, in order to control a dissolution property.

[0019] In order to manufacture the photoresist constituent of this invention, solid content, such as an additive of the surface active agent added if needed [alkali fusibility resin, the above-mentioned radiation-sensitive matter, and if needed / above-mentioned] and others, is first mixed with a solvent well, and it considers as a crude photoresist constituent. A solvent may be thrown in, after holding in a container the solvent which added the surfactant, supplying solid content after that and teaching solid content into a container conversely by the case. After carrying out viscosity control of the obtained crude photoresist constituent, it can obtain the photoresist constituent of this invention with which carries out precision filtration and actual use is presented. Although the pressure filtration by gas, the pressure filtration by pump liquid sending, cycle filtration, etc. can be taken as the filtration approach and the filter made from Teflon, the filter made from polypropylene, the filter made from polyethylene, etc. are mentioned as a filtering medium, the photoresist constituent efficiently made into the purpose can be obtained by using especially the filter made from polyethylene. Moreover, degassing actuation of reduced pressure etc. can also be performed to a photoresist constituent. The photoresist spreading constituent obtained in this way is filled up with and sealed by the container of

protection-from-light nature, and preservation or a distribution channel is presented with it.

[0020] This invention needs to control [ml] the increment of the particle count in liquid after changing this photoresist constituent into the reduced pressure condition of 200mmHg in 500 or less pieces /. Here with the increment of the particle count in liquid Particle with a particle size [of the photoresist constituent by which sealing maintenance is carried out into the container by ordinary pressure] of 0.3 micrometers or more Beforehand, after measuring at the particle counter in liquid, it decompresses to 200mmHg. After [sufficient in ordinary pressure] holding for 10 minutes, and carrying out time amount neglect, the increment over the measured value before reduced pressure when measuring the particle in liquid with a particle size of 0.3 micrometers or more at a particle counter again is pointed out. In this case, it is considered that the air bubbles produced with reduced pressure in addition to the so-called particle are also contained to count.

[0021] In the case of the component of a constituent especially the class of solvent and the amount used, and a mixed solvent, since the particle count in liquid after reduced pressure of this invention photoresist constituent is greatly influenced by the filtration approach of the class of a mixed rate and surface active agent and an addition, and a crude photoresist constituent etc., it chooses these conditions suitably, and it controls [ml] the increment of the particle count in liquid after reduced pressure in 500 or less pieces /. Selection of conditions can be defined by conducting preliminary experiment. If the photoresist spreading constituent by which the increment of the particle count in liquid concerning this invention was controlled is used, a pattern defect can be remarkably decreased so that clearly from the below-mentioned example.

[0022]

[Example] Next, although an example is given and this invention is explained in more detail, this invention does not receive a limit at all according to the following examples, unless the summary is exceeded. In addition, especially, as long as there was no explanation, the handling of the photoresist solution after precision filtration was performed in the clean room of the so-called class 100 of the yellow room which cut light 500nm or less. Moreover, the following were used as the admiration radiation compound used for the example and the example of a comparison, and alkali fusibility resin.

[0023] Admiration radiation compound A: 1 of the resin (weight average molecular weight 1,000) which was made to carry out the polycondensation of m-cresol and the

acetaldehyde (mole ratio 1:0.710), and was obtained, a 2-naphthoquinonediazide-5-sulfonate ghost (it is 40% of rate of esterification to a phenolic hydroxyl group).

[0024] 1 of the resin (weight average molecular weight 1,100) which was made to carry out the polycondensation of admiration radiation compound B:m-cresol and the acetaldehyde (mole ratio 1:0.710), and was obtained, a 2-naphthoquinonediazide-5-sulfonate ghost (it is 25% of rate of esterification to a phenolic hydroxyl group).

[0025] Novolak resin manufactured by carrying out a polymerization using the mixture of 5:4:1 (mole ratio) which consists of a resin A:m-cresol, p-cresol and 2, and 5-xyleneol, and 8:2 (mole ratio) mixture of formaldehyde and an acetaldehyde (weight average molecular weight 3500)

[0026] 8.45g of feeling radiation compound A of example 1, admiration radiation compound B 9.75g, resin A 31.3g, and triphenyl methanol 0.5g were dissolved in the mixed solvent (2-heptanone 135g and propylene-glycol-monomethyl-ether 15g), further, as a spreading disposition top agent, it was set to 50 ppm, appearance addition of the megger fuck F179 (Dainippon Ink make) was carried out, and the stirring dissolution was carried out. Precision filtration of this was carried out with the 0.2-micrometer filter made from polyethylene, and the photoresist spreading constituent -1 was obtained. It enclosed with 250ml and the sample bottle made from polyethylene with a thickness of 0.7mm which made transform beforehand 125g of these constituents with which particle size measured the particle in liquid 0.3 micrometers or more at the particle counter in liquid (Rion make KL-22), and content volume 1/2 was made to reduce beforehand in the clean room of a class 100. It packed so that an opening might furthermore become the minimum by polyvinyl-chloride bag manufacture, and it intercepted with the open air by carrying out the seal of the plastic bag edge with a heat sealer, and considered as the sample. It supplied in the vacuum dryer (LCV made from TABAI ESPEC- 232) which installed this sample outside the clean room the outside whole plastic bag, and the inside of a system was made into reduced pressure conditions with the vacuum pump (GVD135 made from vacuum machine **). Whenever [reduced pressure] is raised gradually, checking whenever [reduced pressure] in the manometer installed in the system, and, finally it decompressed to 200mmHg(s), and held for 10 minutes. Then, the inside of a system is returned to ordinary pressure, a sample is taken out, it is left for 1 hour, and a measurement sample is obtained. Again, this sample was measured on the same conditions and the particle in liquid was measured at the particle counter in liquid.

When the particle count in liquid before and after reduced pressure was compared and the increment was computed, they were 160 pieces/ml.

[0027] The photoresist spreading constituent -2 was obtained by the same actuation as an example 1 except having used the mixed solvent (2-heptanone 120g and propylene-glycol-monomethyl-ether 30g) as example 2 solvent. They were 50 pieces when the increment of a particle count on reduced pressure conditions was measured like the example 1.

[0028] The photoresist spreading constituent -3 was obtained by the same actuation as an example 1 except having used 120g of ethyl lactates, and a propylene-glycol-monomethyl-ether acetate 30g mixed solvent as example 3 solvent. They were 19 pieces when the increment of a particle count on reduced pressure conditions was measured like the example 1.

[0029] The photoresist spreading constituent -4 was obtained by the same actuation as an example 1 except having used the mixed solvent of 2-heptanone 60g and 90g of methyl lactates as example of comparison 1 solvent. They were 1432 pieces when the increment of a particle count on reduced pressure conditions was measured like the example 1.

[0030] The photoresist spreading constituent -5 was obtained by the same actuation as an example 1 except having changed into the filter made from Teflon the filter used example of comparison 2. They were 832 pieces when the increment of a particle count on reduced pressure conditions was measured like the example 1.

[0031] The photoresist spreading constituent -6 was obtained by the same actuation as an example 1 except having changed the addition of the example of comparison 3 spreading disposition top agent megger fuck F179 into 2000 ppm. They were 1350 pieces when the increment of a particle count on reduced pressure conditions was measured like the example 1.

[0032] Each photoresist spreading constituent obtained in the <measurement of homogeneity within field> above-mentioned example and the example of a comparison was applied to the 5 inch silicon wafer in 3000rpm using the spin coater by the great Japan screen company, it acted as the PURIBE king during 60 seconds at 95 degrees C on the hot plate, and the existence of striae SHON was observed using viewing and an optical microscope.

[0033] Each photoresist constituent obtained in the <measurement of the depth of focus> above-mentioned example and the example of a comparison was applied to the silicon wafer with the 5 inch antireflection film in 3000 - 5000rpm using the spin coater by the great Japan screen company, on the hot plate, it acted as the PURIBE

king during 90 seconds at 80 degrees C, and the 0.855-micrometer spreading film was formed. This wafer was exposed through the mask by i line stepper (NSR1755i7A) by NIKON CORP. At the time of exposure, the 0.34-micrometer Rhine & tooth-space pattern was exposed on the conditions to which various focal sides were changed with the light exposure finished in 1:1. Then, postexposition jar BEKU was given for 90 seconds at 110 degrees C, and negatives were developed in 2.38% of tetramethylammonium hydroxide water solution. The pattern configuration formed with the electron microscope was observed, and the focal tolerance from which the good pattern [be / no film decrease] was obtained was measured, and it considered as the depth of focus of each photoresist constituent. It acted as the PURIBE king during 60 seconds at 90 degrees C on the hot plate, and the spreading wafer of 1.015 micrometers of thickness was obtained.

[0034] <measurement of the number of pattern defects> -- except having fixed light exposure conditions and focal conditions and having exposed each photoresist constituent all over the wafer, the pattern was created on the same conditions as measurement of the above-mentioned depth of focus, and the defect in a wafer was measured with defective test equipment. The above-mentioned result was collectively shown in Table -1.

[0035]

[Table 1]

[0036]

[Effect of the Invention] It excels in maintaining the increment of the particle count at the time of reduced pressure to below fixed according to this invention at spreading nature, and there are few pattern defects after development, and a photoresist spreading constituent with the large depth of focus is obtained by high resolving, and the meaning on semi-conductor manufacture is large.

[Translation done.]